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ABSTRACT

This guide for school administrators interested in technology integration in the curriculum was developed from discussions at the Technology Integration Seminar held in March, 1991. The guide is divided into five chapters covering various administrative responsibilities and action steps. The first chapter presents an overview and identifies elements of the integration process (e.g., develop a vision for technology at the site, model technology use, establish a technology committee). The second chapter covers staff development and competencies (e.g., hire personnel with technology backgrounds, set up a mentoring program, and train the trainer). Equipment management strategies are presented in the third chapter. These include making low-tech equipment available to staff, planning for technology resources, and contracting or budgeting for maintenance. Chapter 4 examines the acquisition, access, and management of software (e.g., establish a software library and update products and buy new products). Evaluation and promotion are considered in the last chapter (e.g., set up system for ongoing monitoring, observe evaluation procedures and products, and involve parents). An annotated resource guide lists about 60 articles or documents that support the processes presented in the guide as well as videotape recordings, hardware resources, evaluation sources, software resources, software publishers, associations, and periodicals. (DB)

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Technology Integration: A Thematic Focus

TAKING ACTION

Ideas to Promote Technology Integration

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This guide is for administrators, such as principals, superintendents, technology coordinators, special education supervisors, and curriculum coordinators. It was developed for administrators who are interested in or committed to technology integration in the curriculum.

In this guide special education and regular education researchers and practitioners combine their best advice for administrators who are integrating technology into their school or district.

Taking Action: Ideas to Promote Technology Integration includes a comprehensive set of suggested actions for application in an entire school district, a school building, or the classroom. It is designed to assist you, the administrator, as you develop a plan or identify gaps in a current plan for integrating technology into your particular setting. Furthermore, it can be used to spark additional ideas on how to integrate technology in the schools.

Administrators have the well being of most innovations in their hands. Established school and district wide policies that support innovations help these innovations take hold.

Organization

This guide is divided into five major categories that may be viewed as administrative responsibilities. The chapters are as follows:

Chapter 1. Overview and Elements of the Integration Process
Chapter 2. Staff Development of Competencies
Chapter 3. Equipment Management Strategies
Chapter 4. Software Acquisition, Access and Management
Chapter 5. Evaluation and Promotion of Technology Use

Suggested actions to be taken are presented in each chapter, followed by a brief discussion. Many of these actions can be delegated. However, it is important for the administrator to provide continued support and to select strong leaders that are empowered to carry out these actions.

Please refer to the annotated bibliography, *Administrator's Desk Reference* (1991), for more in-depth information on topics discussed in this document[1]. This reference is available through the ERIC Clearinghouse on Handicapped and Gifted Children

[1] Fazio, E. (1991). *Administrator's Desk Reference*. Center for Special Education Technology, The Council for Exceptional Children, Reston, VA.

Develop a Vision for Technology at Your Site

A technology committee with representatives from many groups including the administrator, needs to develop a vision, a needs assessment, and a plan with goals reachable with the use of technology. The administrator can begin the process by providing leadership to create the vision.

The vision should encompass all aspects of technology. It will be a written philosophy that will facilitate the integration process, as staff and others understand how and why technology fits into the school environment. It is important that this philosophy states that technology can enhance learning for all students including special needs students.

Envision student outcomes that address academic content and describe ways to use technology to attain these outcomes. These methods should focus on technology that supports outcomes for students, rather than technology use as the end goal.

The vision you have for use of technology in your setting can have many facets. One primary use of technology will be for instruction. When used to teach familiar concepts and curriculum, individuals who implement these goals become comfortable with the technology.

For example, designing new instructional curriculum or modifying existing curriculum that includes the use of technology can help teachers understand how this medium may be best used. The process of designing the curriculum will provide the developers with ownership and make them think about how the technology will fit in with their teaching styles and philosophy. When designing a curriculum that includes technology as a tool, include technology-related competencies for students to be sure that they are prepared to use these tools.

The outcomes in the vision statement should be important and understood by administrators so they may be articulated to the community as well as school staff and school board members. Technology should work as the catalyst to accomplish the targeted outcomes.

Model Technology Use

The technology integration process is assisted when administrators use technology to some degree. This does not mean that administrators must type and print their own memos. However, an administrator could make use of technology at a meeting by using a videotape or passing out handouts that have computer graphics on them. These are subtle yet important messages. In addition, if the administrative support staff uses technology to help complete their work it will become clear that technology is a part of the administrator's life and will set an example for the staff. In the school environment, technology can also be used to support administrative planning or clerical and managerial tasks.

It is beneficial to take steps to legitimize the use of technology. The higher up in the school hierarchy this is done the better. However, technology must be embraced and promoted by people on every level of the hierarchy to work effectively.

Identify Needs and Stakeholders

A needs assessment should be conducted to determine what technology use is already in existence and what the staff, parents, and the community foresee as present and future needs. A model such as the Concerns-Based Adoption Model (CBAM) can help give training at the right level to these groups. See the *Administrator's Desk Reference* for information on CBAM. Utilize the needs assessment when writing student outcomes and the philosophy statement. The stakeholders, for example, the computer coordinator or media specialist, need to be identified, as they will be directly involved in implementing the vision as described in the goals and written philosophy. Individuals who may potentially resist the use of technology should be identified to provide a healthy balance in formulating plans and in contributing ideas to make sure the focus is student-oriented.

Involve and Encourage Champions

It is essential that champions or change agents are identified and given the authority to act. Champions are motivated persons distinguished for their interest in technology. For example, he or she might be a teacher who is telecommunicating with Japanese students using a modem, or a teacher who might have students working after school on computers.

If the principal is not one of the champions, he or she should be involved to some degree, even if it is minimal involvement. Without support from the principal most projects will not succeed. In one school district the principal was not noted for his hands-on knowledge of computers, but his verbal support and encouragement, as well as his ample budget for technology, let others know that this was a priority area.

Strong leadership skills including good interpersonal skills and flexibility are needed from champions. The champion also needs to be someone who is accessible and local. The champion serves as a knowledgeable model for others and must be well respected by colleagues. Zorfass (1990) investigates the roles of technology specialists as change agents in *Promoting Successful Technology Integration: Contributions of Technology Specialists*[2].

The administration needs to provide verbal and finan-

cial support for these individuals so that when difficulties arise they have additional resources to call on. Furthermore, a champion's commitment to the integration process will be greatly strengthened if incentives are given. The Rand Corporation [3] has published several reports describing ways to encourage computer use in instruction. Incentives, for example, may be offered as time to attend computer conferences or extra pay for additional responsibilities.

Establishing a Technology Committee

Establishing a technology committee will help to build consensus, ownership, and a power base for integrating technology. Stakeholders and those resistant to technology should be included in the committee.

The membership could include community representation including teachers, parents, and representatives from local businesses. In addition, student participation may be appropriate. Students can contribute concrete reality testing for projected plans.

It is absolutely necessary to extend power to the technology committee to allow the committee to work effectively and to ensure that the committee members put their best efforts into planning.

Develop an Action Plan

An action plan to integrate technology needs to be developed by the technology committee to guide the integration process. Integration of technology is not self-implementing, thus it is necessary to develop this plan. Many teachers can tell you about equipment sitting in closets. Instruction and nurturance of technology use must occur for appropriate use and integration to happen.

An action plan is iterative and ongoing. Members of the technology committee with feedback from other staff will continuously update and renew the action plan as the process of technology integration evolves. As new technology is developed, the district or school will change directions and will need to review the impact on student outcomes. Therefore, a flexible plan with a built-in annual revision process should be developed.

[2] Zorfass, J., Persky, S. & Remz, A.R. (1990, May). *Promoting successful technology integration: Contributions of technology specialists.* Paper presented at the Annual Meeting of the American Education Research Association, Boston, MA.

[3] Stasz, C. & Winkler, J.D. (1985). *District and school incentives for teachers' instructional uses of microcomputers.* Paper presented at annual meeting of the Educational Research Association, Chicago, Il. ERIC Document Reproduction Service No. ED 268-995.

Broadcast That Change Takes Time

In the overall process, it's crucial to acknowledge that change and the addition of new tools will take time. This realization can help to reassure constituents that progress is being made, even though it may appear to be slow. The amount of time needed for teachers and staff to become comfortable with technology should not be underestimated. This principle should also be extended to being tolerant of the length of time it could take for staff to actually integrate the technology with ease. In fact, 3 years may be needed for teachers to become comfortable with a technology and an additional 2 to 5 years needed to fully integrate technology into the classroom.

A system to support converting knowledge into practice should be developed. Using new instructional tools effectively can be extremely difficult, since the teacher must reorganize and rethink the way teaching is conducted in the classroom. Training to use equipment and new methods does not ensure integration of technology. It rarely fits the exact configuration of the teacher's classroom or teaching style. Develop a process to assimilate new information and work it into pre-established patterns.

Teachers should start by considering curriculum and then bring in technology to teach in content areas. To teach learning skills, for example, they may use applications such as word processing, databases, spreadsheets, and telecommunications. Embracing the use of these applications allows technology to become a tool for learning rather than an end in itself. This is a key issue in integration that will take time to be accepted. Videotapes listed in the *Administrator's Desk Reference* illustrate exemplary practice.

Hire Personnel with Technology Backgrounds

A background in technology should be a requirement for all newly hired teachers. This sends a message about the importance of technology use. By hiring technology-literate new staff, tenured staff will have the opportunity to learn some skills from new staff, as well as teach them. By requiring that new teachers have minimal computer literacy and, more importantly, a positive attitude towards technology, the school district can facilitate change within its organization.

Promote Personnel Who Integrate Technology

Another powerful tool is to make technology integration one of the criteria for promotion--for instance, promotion to department chair, principalship, curriculum coordinator, or other district- wide positions. This criterion also serves the purpose of placing technology advocates in key leadership positions.

Acknowledge Risk Taking and Experimentation

The effectiveness of training and using technology may hinge on allowing teachers to experiment with the technology. Encouraging staff to take risks is also important. This type of support is valuable since using technology in the curriculum is primarily uncharted territory. Using new instructional tools opens the door to creativity. Teachers need to know that it is acceptable to experiment and take risks. For example, Wellesley Middle School in Massachusetts includes a statement about teachers as learners and risk takers in their school philosophy.

Recognize Different Learning Styles

A needs assessment to determine staff training needs will provide increased informed decision making. Assess what the content needs are as well as the preferred format of the training. Follow through with the majority opinions and provide feedback for the respondents to increase your credibility. Items presented on a needs assessment form should be realistic and have follow through potential.

In developing a training program the administrator needs to allow for diverse teacher learning styles. Some teachers like to learn by experimenting and exploring on their own, before introducing technology in the classroom. Other teachers need immediate action and want to see the technology work in the classroom without delay. They will learn just enough to get started and move on from there. Teachers may prefer to work with other peers. Peer coaching teams could be established for teachers to work together on integrating technology. Being observed by a peer can provide a wealth of knowledge for the classroom teacher.

Set up a Mentoring Program

Set up a mentoring system to support the ongoing use of technology; An experienced teacher would support and give advice to a teacher who has a lesser depth of knowledge. This may help these teachers generate ideas and plan for new uses of technology.

Some teachers will be able to learn from students; others will be intimidated by the fact that the student knows more than they do. Students can become change agents if teachers and administrators are open to observing and learning from students. Students may have ideas on how to use the technology for instruction that are fresh and

innovative. Students may initiate instruction for their peers or for students in the lower grades. Students need to be encouraged and supported just as faculty members do. For example, students in one district run and manage a telecommunications system for their district, providing an invaluable service and learning many other skills for themselves. An unintended outcome of having teachers learn about technology is that they experience the excitement and frustrations that their students experience everyday in their classroom. By being placed in a novice's position, seasoned teachers have the opportunity to learn something they may have forgotten about the learning/teaching process. It is worthwhile to help teachers see this parallel so that they might renew their level of empathy for those students who struggle with classroom material.

Within a risk-taking framework it is helpful to give teachers options in their level of involvement with the integration of technology. Teachers need to be allowed to work with technology at their own pace and select the type of technology and the applications with which they may be most comfortable.

Entice Staff to Participate

The best training program in any content area will only draw a fraction of the teachers voluntarily. Incentives for training must be built into the program. Incentives come in a variety of forms from monetary to simple recognition of achievement. For example, teachers could receive training on use of a particular piece of equipment and then be awarded a certificate or license to use that equipment and train others. This type of program could include a self-evaluation or no formal evaluation at all in order to decrease possible technophobia anxiety. Part of the "benefits of membership" could include allowing the teacher to take the equipment home for the weekend or over holidays. Develop a policy to facilitate an incentive system. The risks and costs have to be balanced against the positive impact of allowing individuals to borrow equipment.

Develop Awareness of Capabilities

Encouraging integration of technology may be facilitated by providing teachers with an overview of what is available for use. This includes technology that is currently in use and technology that might be available in the future. If the equipment does not reside in the classroom the teacher may not think of using the equipment on a regular basis and even to some extent forget that it is in the building or district. A periodic review of the technology that is available would be beneficial. Along with equipment review, a regular look at how technology is being used should be undertaken and shared with staff.

Recognize Achievers

Acknowledgment and recognition for achievement may encourage teachers to integrate technology. This acknowledgment may come in many formats. For instance, a teacher may be asked to present his or her integration technique briefly at a building faculty meeting, during an in-service day, or at a school committee meeting. A letter of thanks from the principal or a supervisor that is placed in the teacher's personnel file may also be appreciated and could encourage the teacher.

Adapt and Change Schedules

Time for training teachers and students must be allocated for technology to be integrated. This will necessitate changing schedules to accommodate for the time it will take to learn to use the technology. For example, technology use may lend itself to the assignment of cooperative learning projects for students. Furthermore, the way learning occurs may take a different complexity and format. For instance, if students are using a video camera to produce a video as part of a project, class periods may have to be changed to allow students to be able to focus on their project for more than a 50-minute period.

Furthermore, access to the technology may require other kinds of schedule changes depending on how much equipment is available and where it is located. For example, if computer equipment is in a lab, blocks of time need to be allocated during the day for students and teachers to go to the lab. In an elementary school, time to move from the regular classroom to a lab would also have to be accounted for.

Provide Release Time for Learning

Providing release time is another good way to encourage teachers to get involved with technology use. Time to experiment with the technology, observe others using it, preview materials, and just think about how to integrate it can be extremely productive. Release time for studying technology also sends a message that this task is important enough to spend time on.

Visit Other Sites

Teachers and staff may find it valuable to visit other school districts that are integrating technology. To actually see what works with students can inspire many teachers. In order to share a visit with a wider number of staff members, make a videotape of the visit. Interview students, teachers, and administrators. Placement of the

equipment can also be noted by videotaping. Telephone interviews or teleconferences are other possible ways to inform district staff.

Provide Technical Support

Technical assistance must be easily available. An identified individual should be ready so that when some of the equipment malfunctions, it may be fixed rapidly. This is particularly important if teachers are depending on equipment to function properly for a scheduled lesson. The teacher will quickly abandon equipment that does not work properly, since he or she realizes that the instruction is central, not the piece of chalk or the computer. The most valuable support for some teachers may be the service person's telephone number.

Technical assistance is also helpful in setting up equipment. A teacher may be convinced students will benefit from telecommunications, but the thought of setting up a modem can be overwhelming. A knowledgeable person who can work with the teacher the first few times will result in the teacher actually using this technology.

A staff member who is on-site may have the expertise to give effective technical assistance. At least one individual in each building should be available who can provide technical assistance and who has scheduling flexibility to respond to problems as they arise. Another option is to have different people responsible for different kinds of technical assistance.

Alternatively, a centralized service system may be developed whereby staff works from a central location and assists teachers from a remote location. The advantage of using a centralized system is that teachers may become more independent and learn to solve problems or develop creative integration techniques on their own. Furthermore, knowing that they may have to wait some time for a site visit may encourage teachers to pay closer attention to in-service workshops or over-the-telephone instructions.

Build a Professional Library

A subtle ongoing training activity could involve the development of a professional library. The library should contain journals, magazines, books, and videos on technology issues and use. Articles from content area journals and magazines about using technology could be included, for example, articles about early childhood issues, language arts, and mathematics. See the periodicals list in the *Administrator's Desk Reference*.

Establish a Technology Center

Large school districts can establish technology centers to promote and support the integration of technology. Teachers could attend workshops at these centers, test out new technologies, and borrow equipment. Additionally, teachers could work with center staff to find the appropriate equipment and integrative methods for teaching students with special needs. For example, students with severe handicaps may need adaptive devices that need to be fitted precisely to the student's current needs in order for the technology to be functional.

Fairfax County Public Schools in Virginia, have a technology center that purchases and distributes hardware and software, assesses students and determines appropriate technology, provides staff development, suggests technology appropriate for the curriculum, and includes a lending library.

Provide Teachers with Ideas

Provide guidance on techniques of integrating the technology. It is not enough for the teacher to know how to use technology; he or she also needs to be able to use it as comfortably and almost as easily as chalk. The technology must help promote existing curriculum goals and objectives. In the beginning this may involve giving teachers lesson plans and specific suggestions for activities. Teachers should have someone to talk to about possible activities, and, after the lesson to talk about how these activities worked out. Later it may mean encouraging teachers to use applications in new ways. Using the technology successfully involves knowing its limitations as an instructional material, as well as, its strengths.

Hire Consultants

Consultants may be hired for an ongoing introduction to technology with the goal of building in-house capability. Continuous support is essential for successful integration of technology.

Train the Trainer

Use a "train the trainer" model to spread information rapidly and cost effectively. A consultant or university staff could conduct initial training. After teacher trainers have received instruction, construct a system for these teachers to train other teachers. Planning and support from administrators increase success with the "train the trainers" model.

Encourage Participation in University and District Classes

In order to provide training and build inhouse expertise, a district could build links with universities. For example, many institutions of higher education offer free credits in exchange for placing practicing teachers in classrooms. These credits could be exchanged for on-campus classes

in technology or, if enough student teachers were placed, the credits could be negotiated for teachers' in-services. Teachers should be encouraged to participate in university and district classes for recertification credits or continuing education units. In some states and school districts, continuing education units can be used for salary increases, thus providing a monetary incentive.

Schedule Vendor Demonstrations of New Technology

Vendors from local and distant companies will often demonstrate new technologies to teachers free of charge. Awareness of new tools can persuade staff to take risks and to experiment with new instructional materials.

Encourage Conference Attendance with Time and Money

Attending conferences sponsored by technology associations serves a twofold purpose. Supporting participation at conferences can be motivation for teachers and in addition, can provide training. Conferences relating to technology are particularly useful for individuals who have some knowledge of technology and are ready to add new information and techniques to their knowledge base. Half-day or full-day workshops are often available to provide a more in-depth examination of an identifiable topic. People need the time to be able to attend conferences and also need the funds to pay for conference registrations.

Make Low-Tech Equipment Available to Staff

In the rush to become technologically sophisticated, low technology tools and solutions to problems should not be forgotten. Teachers should have access to such equipment as a telephone, copier machine, television, and a VCR. This equipment can be easily and effectively integrated into the classroom. Access to the telephone makes it possible to communicate with parents and others who may have input into the education of students. A copier machine may save hours and also allow teachers to share information with students more easily. Access to a television and VCR will increase opportunities for common student experiences. Cable television channels are producing and broadcasting sophisticated and educationally sound programming for schools. In many cases the educator is allowed to tape a program and then show it to a class later on a VCR.

Ease Staff into Equipment Use

Part of the process of making risk taking viable is giving teachers permission to become comfortable with the equipment. This is true whether the equipment involved is a VCR or a computer. To expect teachers to make innovative use of technology immediately is unrealistic. This kind of expectation can only inhibit use. Giving teachers time, incentives and encouragement will promote their sense of comfort with technology. Technology needs to be viewed as another teaching resource.

Plan for Technology Resources

Equipment issues need to be addressed in the planning stages. However, the plan must be flexible and changeable due to the rapid change of technology. In addition, the constant evolution of ways in which technology can be used in the classroom can be expected. It should be expected that any plan for equipment purchase, placement, and use will be revised.

Schedule Staff Discussion About Access to Hardware and Equipment

A necessary component for technology integration includes hands- on use of the technology. Sufficient equipment must be available for learners to become comfortable with independent use of the technology. The states of Texas, Florida, Oregon, and Missouri have developed central technology support centers that bring technology "on the road," right to teachers.

Furthermore, for training to take effect the teacher must have relatively unfettered access to the technology in his or her building. It is unimaginable to think of requiring a teacher to plan 2 days in advance to reserve chalk for a blackboard. It would be ludicrous for the teacher to have to run down to the supply room in between classes to pick up chalk before using it and then have to return it immediately after use. Granted, technology is more expensive and vulnerable to theft; however, technology will not be treated as a viable instructional tool if it is not accessible.

Evaluate Locations for Equipment

There are three basic options relating to placement of hardware and equipment:

1. A laboratory or special room designated for the equipment that must be visited in order to use the technology,
2. The individual classroom where there is at least one computer with software, or
3. Equipment that is portable and is moved from classroom to classroom based on some type of a preplanned schedule or need.

The location of equipment is determined by asking teachers what location would help make integration of technology for students most feasible, and by considering financial resources and security of equipment. For example, funds to make certain renovations such as updating the wiring, could be necessary to accommodate the technology.

Laboratory Location

If a laboratory setting is selected, a room must be found that is centrally located to minimize student and teacher travel time to reach the lab. It may be necessary to hire a technology coordinator or assign an individual to oversee the room. This person would provide continuous monitoring of equipment and assist teachers and students in integrating the technology. Regarding computer technology, a decision must be made to purchase a networked system or stand alone computers based on teachers' needs and preferences, budget constraints, and staffing availability. There will be decisions regarding location and management of a software library and installation of a security system.

Classroom Location

Selecting a classroom location means that the teacher must reallocate space in the classroom. Teachers and students must learn to live with noise created by excited students and printers. New classroom routines need to be formulated so that teachers and students alike see the equipment as an integral part of the classroom environment. Encourage and support software use and exchange among classrooms. The classroom location has the

potential to present security problems that must be examined and addressed.

Portable Equipment

Using portable equipment that moves from room to room requires a tracking and scheduling system. Teachers need to plan in advance for use so that they may maximize use. Equipment may be reserved on a day-to-day basis or assigned to a classroom for a period of a week, month, semester, or year. Whatever placement is selected, there should be an openness to changing the location of the equipment if staff feels the placement is not functional. Feedback from staff and monitoring of use can determine whether or not the selected equipment location is working.

Provide the School/Classroom with Telecommunications Equipment

Telecommunications can provide students with the opportunity to contact other students worldwide, to obtain information from bulletin boards, and to retrieve information from databases for conducting research. Equipment needed for telecommunications includes a computer, modem, telecommunications software, a telephone line, and a telecommunications system with which to connect.

Develop a Schedule For Use of Equipment

Regardless of where the equipment is placed, use must be scheduled. To encourage integration, it is preferable to be able to use the equipment as freely as possible. However, this is often not the case; therefore, laboratory use or use by an individual student or group of students must be planned in advance. This is helpful so that class learning time is not wasted negotiating when to use the equipment.

Periodic assessments concerning access need to be conducted. If the results of these assessments indicate that not enough equipment is available or the location makes it inaccessible, then this information needs to be shared with those who are empowered to make changes.

Insert a Line Item Budget or Equipment

It is essential to establish technology equipment as a line item expenditure in the district or school building budget. Once technology use is embraced, it is virtually impossible to do without the technology. For instance, technology will be more than a one time purchase of computers.

Contract or Budget for Maintenance

Equipment that is extensively used can repaired by maintenance contracts, a repair budget, or inhouse maintenance.

Maintenance Contract

A yearly maintenance contract can be bought along with the equipment. This contract may entitle your district to on-site or off-site repairs. Once the warranty on the equipment has expired, parts must be paid for above the cost of the maintenance contract.

Repair Budget

Some administrators have found that it is cost effective to set aside 10% of the cost of equipment per year to cover maintenance costs. The potential advantage of this type of budgeting is that if fewer repairs are needed in one year then those monies may be carried over to the next year or may be used for other expenditures. However, if too many repairs are needed, funds may have to be found elsewhere or equipment will remain idle.

In-house Maintenance

Some districts may be fortunate to have a staff person who is able to repair equipment. If not, it is possible to have someone trained to repair equipment. The district may make this part of a staff member's job description.

Arrange for Quick Turn Around on Repairs

Regardless of how maintenance is provided, in order for technology integration to work, rapid repairs for equipment that is not working must be available. Equipment users need to know maintenance procedures.

Provide Funds to Upgrade and Replace Outdated Equipment

Funds must be available for upgrading equipment. Although some equipment may be old, it may be used for other purposes if it is added to in some way. Outdated equipment that is too old to be functional should be replaced. Old equipment can discourage teachers and students because it is cumbersome to use or no one is available to provide training.

Make Decisions to Determine When Equipment is "Dead"

Although it can be difficult to dispose of equipment, it must be done or the old equipment can serve as a bottleneck to acquiring new technology. Decide the criteria to determine when equipment is no longer

functional and appoint someone to implement the process.

Alert Staff to Investigate Alternate Funding

Districts should be creative in obtaining technology, especially if the need for technology use has not as yet been firmly established. Obtaining alternate funding sources to demonstrate the effectiveness of integrating technology could incite the district to request funds for technology. The National School Boards Association's *On Line, Financing Strategies for Educational Technology* (1989), discusses innovative financing alternatives to accomplish the goal of providing technology for all students. See the Administrator's Desk Reference for more information.

State and Local Funds

Most state governments provide grant money for which school districts can apply. State grant applications may need to address a specific educational issue. However, many issues can be addressed with the use of technology. If motivated, local governments can post an initiative to support the purchase of technology. If a school is being renovated or a new school is being built, districts will often invest funds in technology for the school.

Charitable Groups and Foundations

There are many local and national charitable groups and foundations that give funds for education. Investigate some of these organizations to determine if your goals match the interests of these groups. Most of the large computer companies have grant programs by which they donate equipment, employee time, funds, or other support to promote the use of technology.

Business Community Support

Many large- or medium-sized local businesses hire individuals to dispense donations to worthy causes in the community. Contact these businesses for funds for technology projects. Instead of giving money some businesses will donate their unneeded equipment or staff time for projects.

Provide for Access to Software, Tapes, or Films

Easy access to software, tapes, or films is necessary to enable teachers to integrate technology. There must be enough current materials available for the instructors.

It is advisable to preview all materials before purchasing or using them in the classroom. A system that facilitates this process needs to be established. In addition, sharing information among staff regarding integration of materials in the curriculum is very useful. Teacher recommendation of software is one of the most effective ways to encourage teachers to use a new piece of software.

Establish a Software Library

Establishing a library of materials with abstracts, recommendations, or descriptions of materials will help increase circulation and usage. Some teachers may prefer to have a small library of software or other materials that remain in the classroom at all times. Classroom collections may be effective for some teachers, however, for others it may not encourage them to use newer materials. Some teachers may keep software in the classroom and never use them due to lack of time, thus denying access to the rest of the school community. It is helpful to have an inventory of materials and to keep track where they are located. Check occasionally to see if the materials are being actively used.

Develop a system to distribute or share software and other similar equipment to help teachers keep current. Equipment can be distributed from a central location in the building or district. An individual, such as the librarian, media specialist, computer coordinator, or a classroom teacher should be assigned the task of keeping track of the equipment. Circulation will be facilitated by developing a database with information, including the title of the equipment, the subject it addresses, current location, grade level, and other items as needed. The database information can be organized and printed out to meet the needs of the person using the database information.

Buy Site Licenses or Lab Packages

It may be cost effective to purchase site licenses or lab packages for specific products that will be used building- or system-wide. For example, purchasing a site license for a word processing piece of software may help to encourage wide use of the software. This type of purchase is usually negotiated with the software developer; the price of the license may reflect the numbers of students or buildings in the district.

Update Products and Buy New Products

Improvements on individual pieces of software are continuously developed and can be purchased for a nominal fee. These updates are available for registered users who sent the warranty card to the software developer. In addition, new products and innovations are constantly being produced. Students and teachers should have access to improved materials. A budget or line item for both updated and new products will enable the purchase of these materials.

Advertise Your Copyright Policy

Although funds are scarce, it is illegal to copy most software. Districts need to help teachers and students clearly understand this. The school should serve as a model for the community by disseminating laws regarding copyrighted material and by displaying these laws in appropriate locations. Refer to the *Administrator's Desk Reference* for articles that examine ethical issues that administrators must consider.

Arrange for Local Vendors' Discounts and Training

Local vendors may provide teachers with discounts on products and services. The district or the vendor can arrange this. Discounts have the potential to draw in buyers who might otherwise not become involved with technology. As previously noted, it is advantageous for the teacher to become personally involved with using technology to become comfortable with it. The teacher can embrace the technology on his or her own terms. Vendors may also include training in the purchase price of their products. If a number of vendors are competing for a bid this may be a way to differentiate one vendor from another. It is especially beneficial if teachers can participate in training within their own time frame.

Offer Minigrants

Offer open-ended minigrants to teachers to spur excellent ideas for technology integration. For example, a special education teacher in one school requested a VCR camera to use in her classroom. The teacher found that showing the tape of the filmed students helped the students understand how some of their behaviors affected their work and the classroom environment as a whole. Giving a relatively small amount of money to teachers may produce some dramatic results.

Establish the Goal to Help Students and Teachers

Focus evaluation of effective technology integration on helping students and teachers. Evaluation questions can be concrete as well as open-ended to facilitate the gathering of desired and unanticipated information. Analyze data and develop an action plan to implement suggestions gleaned from the evaluation. Likewise, include an informal evaluation and check with technology users to see what resources are needed.

Examine the integration of technology to determine what is and what is not working. Admit that a plan or a program is not "perfect" and look at problem areas constructively to save money, time, and energy. In fact by pointing out the problems, the program will become better. In some instances ignoring the difficulties might actually cause the demise of a program.

Set up a System for Ongoing Monitoring

Once technology use is underway, set up a system to monitor its use. Monitoring will help determine directions for future use, as well as assist in substantiating the need for resources to support technology use. The monitoring system can be formal or informal and can be achieved by sending out surveys, by observation, and/or by occasional meetings or forums. A positive side effect of setting up a monitoring system is raising the awareness of those who participate in the monitoring system.

Gather Information From Surveys or Questionnaires

Surveys or questionnaires can be formulated and sent out periodically, such as once, twice, or three times a year. These questionnaires should include goals and priorities for the school district, the academic and administrative restructuring necessary to achieve the goals, the budgetary allocations and reallocations necessary to implement the restructuring, and the reward systems to be instituted at the school level. Ongoing communication with the vice president/superintendent and the school board should continue for day-to-day administrative matters.

Observe Evaluation Procedures and Products

Visiting sites and talking to teachers, parents, and students can provide rich information for the evaluation process. By actually seeing students use technology and by viewing end products that have been developed, these methods can be used independently for evaluation or along with other evaluation methods. Remember that observation cannot be necessarily generalized to the entire population but can serve as a case study to inform others.

Discuss the Effect of Technology on Learning

Focus on whether the use of technology impacts student learning positively. Return to this time and time again. Try to separate technology from other variables. Ask whether a particular concept could be taught just as well without the use of technology or whether technology measurably enriches the learning process.

Invite a Mixed Audience to Meetings

Bring both technology users and nontechnology users together to generate information about what works and what does not work. Hire a facilitator to help staff self-evaluate and compare what they are doing with technology with other teachers. Include individuals with the power to implement suggestions that are presented during this informal evaluation.

Discuss How to Make It Better

Isolate rough places for the first step in the evaluation process, and follow by adjusting uses of technology to make it work better. Use a technology committee and involve people who are having difficulty. For assistance, keep up with current practices and innovations.

Let Newsletters Tell Your Story

Awareness and education about technology can be disseminated to teachers and others by publishing a newsletter describing the use of technology and by using desktop publishing technology to produce the newsletter. Do not assume that the readers are aware of the fact that technology was used to produce the newsletter.

Conduct Open Forums

Conduct open forums for teachers, parents, students, and community members to highlight some of the uses of technology, and to discuss some controversial issues, such as when to start keyboarding or word processing, or whether or not to have cable TV in the schools.

Involve Parents

Many parents are not technology users; therefore, their interest needs to be nurtured. Parents need to see how their tax money for technology will help to improve their child's education. Using technology for its own sake will

not motivate parents as much as seeing how it will help their child learn more and better.

Invite parents into the schools, have students bring products home, ask parents to sit on technology committees, and send classroom, building or district-wide news about technology to the parents. Keep them continuously informed so that when budget items or curriculum changes occur the parents can be an ongoing part of the decision-making process.

Inform the Community

Nurturing technology integration can be accomplished in many ways. Use the media to keep your building, district, and community informed about your successful use of technology. Keep your school board informed, not only at meetings but also by scheduling events that you can invite school committee members, parents, and other community members to participate in or to observe. Share products with these individuals, whether it is simply written materials or a videotape production of Hamlet.

Involve the Community

Support from all corners of the community will help encourage teachers to integrate technology. This support may be nurtured by allowing members of the community to have access to equipment or by inviting individuals to share their knowledge and expertise with students and teachers. Providing the community with access to the technology in the schools can serve as a valuable public relations tool. For example, adult education classes might be offered during nonschool hours. Another program might be instituted whereby parents or community members visit the classroom regularly and assist students who are working with technology. These individuals could have prior technology knowledge or could be trained by school staff.

Offering courses for parents and other community members will help to promote and protect the integration of technology. By offering the opportunity to use school technology the concept of family learning can be supported. Parents and community members will feel less alienated from the schools and the curriculum currently being taught to their youngsters. Community access will help to establish a model for lifelong learning. The publicity regarding technology advances can be the hook to draw adult learners into becoming involved.

Technology Integration: A Thematic Focus

ADMINISTRATOR'S DESK REFERENCE

Readings to Promote Technology Integration

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Center for Special Education Technology

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INTRODUCTION

This *Administrator's Desk Reference: Readings to Promote Technology Integration* is a companion piece to the Center's publication *Ideas to Promote Technology Integration*. Both documents are products of a seminar held at the Reston headquarters of The Council for Exceptional Children on March 12-13, 1991. The goal of the seminar was to articulate the findings of research and successful practice on the topic of technology integration.

This *Desk Reference* is an annotated bibliography of articles that support the processes of planning, facilitating, and evaluating technology integration, as described in the *Ideas* document. The following topics are addressed:

- Overview and Elements of the Integration Process
- Staff Development and Competencies
- Equipment Management Strategies
- Software Acquisition, Access and Management
- Applications for Instruction
- Evaluation and Promotion of Technology Use
- Resources for Technology Integration

Model Integration Projects

Anderson, M. A. (1990). Technology integration for mainstreamed students. *The Computing Teacher, 18*(4), 6-8.

This article highlights teacher practices in successful integration of technology found in three studies conducted by Johns Hopkins University researchers, Education Development Center, Inc., Technical Education Research Center (EDC/TERC), and Macro Systems, Inc. (Macro). Because each of the studies focuses on a different school level, the author also provides details on some of the specific findings from each of the research projects.

Center for Special Education Technology. (1990). *Marketplace report: Research highlights on technology integration*. Reston, VA: The Council For Exceptional Children.

This Marketplace report presents an overview of the findings of three federally funded research projects focusing on technology integration. Macro Systems' research with high-school students indicates that effective integration of technology is dependent upon several factors: leadership, technology competence, good communication, accessible resources, and a guiding statement of goals. At the middle-school level, researchers at the Education Development Center, Inc., have developed a model entitled "Make It Happen!". Designed to guide schools through a 3-year change process, the program emphasizes collaborative planning and teaching. Results of studies by Johns Hopkins University researchers at the elementary level form the oasis of the Technology Integration Enhancement Model (TIE). Materials developed to support the model include modularized staff development manuals and the *Teachers' Technology Resource Guide*.

Hanley, T. V., Appell, L. S., & Harris, C. D. (1988). Technological innovations in the context of special education systems: A qualitative and structured research approach. *Journal of Special Education Technology, 9*(9), 98-108.

A multimethod (both quantitative and qualitative) study of the integration of CAI into the curriculum for high-school students with mild disabilities is described. Preliminary findings support efforts in four areas: needs assessment procedures, software selection, inservice training and technical assistance, and school communications mechanisms.

Morocco, C., & Zorfass, J. (1988). Technology and transformation: A naturalistic study of special students and computers in the middle schools. *Journal of Special Education Technology, 9*(2), 88-97.

This article describes the 3-year Education Development Center/Technical Education Research Center project which investigated how technology is integrated into language arts and mathematics curricula, and its impact on mainstreamed students with mild disabilities. Evaluation of computer use at four diverse school systems was observed.

Panyan, M. V., & Others. (1988). The integration of technology in the curriculum. *Journal of Special Education Technology, 9*(2), 109-19.

Described is a 3-year research project to develop an applications model to successfully integrate technology in the instruction of elementary-grade students with mild and moderate disabilities. The model focuses on decisions of school personnel in such areas as identification of content, instructional methods, organization of instruction, and outcome assessment.

Restructuring

Held, C., Newsom, J., & Peiffer, M. (1991). The integrated technology classroom: An experiment in restructuring elementary school instruction. *The Computing Teacher, 18*(6), 21-23.

Key elements of the Integrated Technology Classroom (ITC) project include development of the teacher's personal vision of instruction with technology, multiaged grouping of students, LEGO/Logo for part of the science curriculum, laptop computers for writing in language arts, a camcorder for student projects and presentations, Macintoshes for publishing of children's stories and problem-solving software from companies such as Sunburst and MECC.

Ray, D. (1990). Technology and restructuring part I: New educational directions. *The Computing Teacher, 18*(6), 9-20.

First of a two-part series exploring the relationship between technology and school restructuring. Ray highlights 16 emerging educational directions and the ways in which technology can play a major role in furthering each one.

Ray, D. (1991). Technology and restructuring part II: New organizational directions. *The Computing Teacher, 19*(7), 8-12.

This second part of a two-part series examines new organizational directions for education. Restructuring schools are described as moving towards a model that is characterized by communication and information processing, redundancy of functions, learning to learn, requisite variety, and minimum critical specification. Strategies for enhancing the technology-restructuring relationship are also provided.

Sheingold, K., & Tucker, M. (1990). *Restructuring for learning with technology*. New York, NY: Center for Technology in Education, Bank Street College of Education.

This is a collection of papers inspired by three developments in relation to education: advances in our understanding of student learning, and of how to create educational environments that foster students' thinking and engagement; the potential of currently available and future interactive technologies to support student learning and thinking; and restructuring and reform efforts that have at their core a commitment to higher-order learning and thinking for all students.

Vision Setting and Strategic Planning

Bryson, J. M. (1988). *Strategic planning for public and non-profit organizations*. San Francisco, CA: Jossey-Bass, Inc.

Bryson presents an eight-step strategic planning process for public and nonprofit organizations in this book. The process includes policy and direction setting, internal and external assessments, dealing with stakeholders, identification of key issues and strategies to deal with each issue, decision making, action, and monitoring. How to apply this approach is described in detail. Six resource sections include sample strategic planning worksheets, literature reviews, and examples developed in response to strategic issues.

Hall, G. (1986). *Deriving teaching skill from studies of the implementation of innovations in education*. Austin, TX: Research and Development Center for Teacher Education.

This paper examines research on the change process with emphasis on implementation of educational innovations. Three diagnostic dimensions of the Concerns-Based Adoption Model (CBAM) are used to describe the development of teacher skills: Stages of Concern, Levels of Use, and Innovation Configurations. Research findings concerning the amount of time needed to develop teaching skills and expectations for individual teachers are discussed. A two-page list of references is included in the document.

Loucks, S. F., & Hall, G. E. (1979, April). *Implementing innovations in schools: A concerns-based approach*. San Francisco, CA: Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Loucks describes the application of the Concern-Based Adoption Model (CBAM) to a curriculum implementation effort. CBAM is designed to describe change as it affects individuals and to prompt more successful change efforts. Some of the study's results have direct implications for facilitators of change efforts. First, the actions taken by building principals to support or inhibit a change effort have direct effect on how teachers feel about and ultimately use a new program. Second, implementing an innovation takes more than 1 year. Change facilitators and policymakers should set realistic expectations for themselves, teachers, administrators, and evaluators.

Moursund, D., & Ricketts, D. (1987). *Long range planning for computer use*. Eugene, OR: Information Age Education.

Problem solving and the authors' strategic planning process are the focus of this book. Nineteen issues and special topics of concern are discussed including: computer-integrated instruction, home computers, hiring computer educators, life expectancy of hardware and software, artificial intelligence, and acquisition and storage of software.

National School Boards Association. (1989). *On Line: Policies and planning for educational technology*. San Diego, CA: Jostens Learning Corporation.

This volume guides readers through the key issues of developing new planning and policy-making skills by offering case studies and examples of districts' plans. One of the seven chapters focuses on the role of staff development; another tells how to plan school facilities that can maximize technology's potential.

National School Boards Association. (1989). *Planning for telecommunications: A school leader's primer*. Portland, OR: U. S. WEST Communications.

This NSBA publication outlines a systematic approach to incorporating technology into the educational system. This approach is divided into three stages: vision, policy, and architecture. School leaders will find advice on how to envision the future of education, plan for the purchase and implementation of equipment, and ensure that the technology selection is made within the context of curriculum needs.

The Technology Champion

Hancock, V. E. (1990). The role of the lab coordinator in promoting computer use among secondary school faculty and students. *SIGTC Connections, 7*(2), 19-20.

Hancock proposes that a school needs at least one person to act as a catalyst for computer use. The article reports the results of a survey conducted in order to evaluate the success of a middle-school computer lab and the lab coordinator's effectiveness. The responses of students and teachers indicate that the coordinator serves several critical functions: he or she troubleshoots, instructs, schedules classes, and provides technical assistance.

Handler, M. G. (1990, May). *A computer coordinator's network: Filling a collegial void*. Paper presented at the Technology and Teacher Education Conference, Greenville, NC. (ERIC Document Reproduction Service No. ED 322 112)

This paper describes the development and evaluation of a computer coordinators' network, which was designed to provide support for teachers who have responsibility for computer education in elementary schools of their district. The value of networking as a form of staff development is demonstrated.

Sheingold, K., & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice*. New York, NY: Center for Technology in Education, Bank Street College of Education.

This document reports the results of a national survey of a special group of teachers recognized for their significant accomplishments with technology. The authors found that these teachers have spent much time mastering computer-based practices and approaches – fully 5 to 6 years on average. Further results of the survey indicate that accomplished technology users are not working in a vacuum, use computers as multipurpose tools, and tend to shift their computer-based practices over time.

Strudler, N. B., & Gall, M. D. (1988). *Successful change agent strategies for overcoming impediments to microcomputer implementation in the classroom*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA. (ERIC Document Reproduction Service No. ED 298 938)

Computer coordinators were analyzed in terms of their strategies, skills, and outcomes. Results revealed: (1) impediments to the integration of computers include lack of budgetary support, competing demands on teachers, and previous negative experiences with innovations; (2) coordinators facilitate computer use through a combination of product and client-centered strategies; (3) effective coordinators must have technical expertise as well as interpersonal skills; (4) outcomes resulting from the computer coordinator's work include improved teacher skills, implementation of school goals, teacher satisfaction, and greater student comfort with computers. Guidelines for the implementation of the coordinator role are suggested.

Staff Development

Center for Special Education Technology. (1991). *Directory of technology training materials*. Reston, VA: The Council for Exceptional Children.

This directory was developed to assist trainers by providing a comprehensive list of technology training materials. Materials are organized in four sections: training materials, which include videotapes, software, and other instructional materials; curriculum guides, which include comprehensive and small training units; textbooks, for introductory and methods courses; and a master index, which categorizes materials by author, title, and medium.

Fisher, G. (1989). Planning, staff development, and technology. *Journal of Reading, Writing, and Learning Disabilities International*, 5(1), 103-111.

An approach to developing the technological skills of school personnel by promoting individual growth is explored. Considerations in planning technology staff development activities include focusing on instruction rather than hardware and software, involving everyone in the planning process, offering a variety of educational experiences, and offering recognition and incentives.

Goodson, B. (Ed.). (1991). *Teachers and technology: Staff development for tomorrow's schools*. Alexandria, VA: National School Board Association.

ITTE's latest special report explores the importance of teachers sharing their own technology knowledge and the benefits of peer training as a method of staff development. The importance of teachers learning how to integrate technology into their lessons versus just learning to be technology literate is examined.

Hall, Gene E. (1983). *Client concerns: A guide to facilitating institutional change*. Austin, TX: Research and Development Center for Teacher Education.

This paper on staff development examines one dimension of the Concerns-Based Adoption Model (CBAM) as a diagnostic tool for use by administrators and others who are responsible for the timing and delivery of staff development experiences. A rationale for staff development, the necessity of organizational change, and the role of change facilitators are discussed in an initial section. The CBAM model is described and the seven stages of concern are defined. Levels of intervention corresponding to the stages of concern, with specific tactics and strategies, are proposed.

International Society for Technology in Education (ISTE). *Independent Study courses*. Information available from: ISTE, 1787 Agate Street, Eugene, OR 97403, 503/346-4414.

The International Society for Technology in Education (ISTE) has developed 11 distance education courses that allow educators to keep abreast of the latest uses of technology in schools and to earn graduate credit while they work. Students correspond with instructors by mail, fax, or telecommunications. Graduate credit is offered through the Oregon State System of Higher Education.

Moursund, D. (1989). *Computer integrated instruction: Effective inservice series*. Eugene, OR: International Society for Technology in Education.

This series includes five manuals designed to assist administrators and others design and deliver effective in-service training for integrating the computer into the classroom. The manuals focus on the following topics: the research base behind CII recommendations; computer integration for the elementary level; and computer integrated instruction for secondary school science, social studies, and mathematics. Each volume contains a hard copy and Macintosh disk version that allows users to customize the materials.

Salpeter, J. (1989). Inservice training: Help from publishers? *Classroom Computer Learning, 9*(5), 20-24.

Leading software publishers were surveyed in order to identify the kinds of teacher training services that they offer. Workshops conducted at national conferences and customized on-site training are discussed. In addition, Salpeter explores in-service opportunities provided by select hardware manufacturers.

Scrogan, L. (Ed.). (1989). The OTA report: Teachers, training, and technology. *Classroom Computer Learning, 9*(4), 80-85.

Conclusions drawn by the Office of Technology Assessment on integrating new technologies into the classroom are examined. The article lists steps for training success, factors contributing to effective in-service computer education programs, barriers to technology acceptance, and priorities recommended for colleges of education.

Woodhouse, D., & Jones, A. (1988). Professional development for effective use of computers in the classroom. *Evaluation and Program Planning, 11*(4), 315-323.

This journal article describes an approach to training teachers to use computers in the classroom. Five issues are considered: (1) reactions to innovation, (2) competing demands for teachers' time, (3) adaptation of available software, (4) integration of courses and practical experience, and (5) provision of ongoing support.

Training Materials

Access Unlimited. (Producer). (n.d.). *We have something to say* [Videotape]. Houston, TX: Author.

This video shows over 25 children with special challenges, at seven different sites, working spontaneously with adapted computer devices and software used with Apple computers. The youth range in age from 17 months through 22 years. All are experiencing physical or cognitive barriers to learning and are interacting with readily available special computer options. Available from: Access Unlimited, P.O. Box 7986, Houston, TX 77270, 713/461-0006.

Georgia Learning Resource System. (Producer). (1991). *Adaptive devices for students with disabilities* [Videotape]. Augusta, GA: East Georgia Learning Resource System.

This videotape provides a review of adaptive devices for computers, including keyboard modifications, adapted keyboards, and switches. Available from: Joan Basile, East Georgia Learning Resource System, 3108 Lake Forest Drive, Augusta, GA 30909, 404/731-8777.

International Society for Technology in Education (ISTE). (Producer). (1990). *For all our children* [Videotape]. Eugene, OR: Author.

ISTE conducted a project entitled VISION:Test (Technology Enriched Schools of Tomorrow). This videotape is a compilation of the 45 site visits that were conducted as part of the study. Children, teachers, and administrators are interviewed at schools that use technology in a wide variety of ways and do so with great success. All attribute their success to the use of technology. All modified their structure and invested in training their teachers. Available from: ISTE, 1787 Agate Street, Eugene, OR 97403, 503/346-4414.

National Lekotek Center. (Producer). (1990). *Opening closed doors: Implementing computers into the special education curriculum* [Videotape]. Evanston, IL: Author.

A discussion and demonstration of effective computer use for children with special needs. Children with various disabilities are depicted using computers in various settings. Available from: National Lekotek Center, 100 Ridge Avenue, Evanston, IL 60201, 708/328-0001.

S. L. Productions. (Producer). (1990). *Power On! New tools for teaching and learning* [Videotape]. Manhasset, NY: Author.

Produced to accompany the OTA report of the same name, this is a comprehensive look at the status of computers, video, and telecommunications in public schools, including a look at their impact on teachers. It also examines the potential for these new technologies to change education in the future. Available from: S. L. Productions, Box 1243, Manhasset, NY 11030, 516/365-9458.

Tom Snyder Productions. (Producer). (1989). *One computer classroom* [Videotape]. Cambridge, MA: Author.

This video includes practical classroom suggestions and examples of how to use specific programs. Also included is a video catalog of all Tom Snyder Productions titles. Perfect for workshops, teacher education, and computer coordinators introducing the TSP philosophy or product line. It is free to any educator on a 30- day loan or it may be purchased. Available from: Tom Snyder Productions, 90 Sherman Street, Cambridge, MA 02140, 1-800/342- 0236.

Promoting Change

Sheingold, K., & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice*. New York, NY: Center For Technology In Education, Bank Street College of Education.

This document summarizes the results of a nationwide survey of teachers who are experienced and accomplished at integrating computers into their teaching. The range of practice with currently available technology, the perceived value of these practices, and the circumstances that may promote or hinder effective technology use are described.

Stasz, C., & Winkler, J. D. (1985, April). *District and school incentives for teachers' instructional uses of microcomputers*. Paper presented at annual meeting of the Educational Research Association, Chicago, IL. (ERIC Document Reproduction Service No. ED 268 995)

Results of this study indicate that adequate technical support is the most important determinant of increased integration of microcomputers into regular instruction. In addition, more varied microcomputer use was found when the teacher had a voice in selecting courseware for acquisition by the district. Preliminary findings also suggest that "intrinsic" incentives, (a computer set aside for teacher experimentation), and "extrinsic" incentives (the possibility of a promotion and a pay raise) play an influential role in stimulating technology use.

Stone, K. S. (1988). Making the computer connection. *Instructor, 98*(3), 28-29.

Suggestions are given for increasing teacher involvement with school computers. The computer coordinator's role, teacher training, applications, and student activities are discussed.

Zorfass, J., Persky, S., & Remz, A. R. (1990, May). *Promoting successful technology integration: Contributions of technology specialists.* Paper presented at annual meeting of American Education Research Association, Boston, MA. Newton, MA: Education Development Center.

One purpose of this study is to investigate the roles of technology specialists as change agents. Zorfass seeks to identify: (1) major categories of intervention strategies that technology specialists employ; and (2) relationships between the presence of these strategies and the scope of the technology specialist's role as a change agent. A second purpose is to understand how the roles that technology specialists play may be related to promoting successful technology integration. The results of the study can guide administrators in making critical decisions about staffing.

Access and Equity Issues

Center For Special Education Technology. (1989). *Tech Use Guide: Computer access.* Reston, VA: The Council for Exceptional Children.

This guide provides an overview of the variety of methods and devices that can be used by a disabled person to gain access to computer technology. Three main access functions are considered: input devices (high- and low-tech), output devices and computer interfaces. Following the discussion of access aides, a practical list of resources includes entries on each type of technology considered: simple and advanced switches, video pointing devices, modified and alternative keyboards, voice recognition, optical character readers, computer and noncomputer dependent output devices, speech synthesizers, and computer interfaces.

Clinton, J., & Others. (1986, January). *Implementing equal access computer labs.* Paper presented at the Florida Instructional Computing Conference, Orlando, FL. (ERIC Document Reproduction Service No. ED 273 241)

This paper discusses the efforts of Palm Beach County, Florida, to implement equal access computer labs. The document provides guidelines for establishing criteria and systematic observation of students who may require adaptive devices and a list of suggested hardware to place in an equal access lab. Appendices include listings of adaptive peripheral devices for computers and applied technology resources.

Corwin, J. K. (1986, January). *What to do when the micro fails.* Paper presented at the Florida Instructional Computer Conference, Orlando, FL. (ERIC Document Reproduction Service No. ED 272 162)

This brief description of the microcomputer service and maintenance system of a community college includes a series of hints and tips, lists of information sources and suppliers, and regulatory codes that could be helpful to school districts that wish to conduct on-site repair of computers.

Cowles, J., & Others. (1986, February). *Computer laboratory management: Making effective use of your computers.* Paper presented at Ohio State Department of Education Computer Fair, Columbus, OH. (ERIC Document Reproduction Service No. ED 274 335)

Information on the establishment and management of a school microcomputer laboratory is provided in this paper. The Lancaster (Ohio) city schools serve as a model for discussing concerns encountered in managing labs, and for providing descriptions of the techniques and methods that have proved successful in operating, managing, and controlling the computer hardware and software. Appendices include copies of licensing procedures, software lists, student worksheets and tests, and other items developed to promote and manage the Lancaster labs.

Fredman, A. (1990). *Yes, I can: Action projects to resolve equity issues in educational computing.* Eugene, OR: ISTE.

This document reports on eight projects developed to identify and remove inequities in computer access for girls, minorities, economically disadvantaged students, and students with physical disabilities. General results include changed perceptions of self and of computers and greater involvement of staff and administration in equity efforts.

King, R. A. (1987, April). *Computer equity and the role of district level computer coordinators*. Paper presented at the annual meeting of the American Educational Research Association in Washington, DC. (ERIC Document Reproduction Service No. ED 285 577)

The importance of leadership in computer access and the role of the computer coordinator were examined in depth. Results of the study appear to indicate that leadership and commitment at all levels in the educational hierarchy are more important for providing computer access for pupils than the demographic and financial characteristics of the school districts. Specific recommendations for improving computer equity are provided.

Moran, T. (1987). The ideal computer lab from floor to ceiling. *TechTrends, 32*(2), 18-20.

This description of an ideal school computer laboratory focuses on physical characteristics and includes guidelines for floors, walls, ceilings, doors, wiring, seating configurations, and furniture.

Funding

Center For Special Education Technology. (1990). *Selected readings: Funding technology programs and devices*. Reston, VA: The Council For Exceptional Children.

Administrators are provided with an overview of selected books, articles, and reports on funding technology programs, services, and products. The entries include directories that list federal, state, private, and corporate funding sources; guides that focus on grantsmanship; and manuals that provide strategies on the process of finding and winning funding for assistive technology.

Friedland, M. (1990, May). Computer leasing adds up for education uses. *School Business Affairs, 56*(5), 36-37.

Many school business officials have turned to computer equipment leasing. A lease arrangement permits administrators to stretch annual budgets, to appropriate funds, and to easily upgrade or change equipment. Another alternative to high-cost computer purchase is to buy or lease used equipment.

Hoffman, A. (Ed.). (1991). *The many faces of funding.....* Mill Valley, CA: Phonic Ear, Inc. Available from: Phonic Ear, Inc., 250 Camino Alto, Mill Valley,CA 94941, 415/383-4000.

This monthly newsletter provides educators and parents with highlights of what is available under third-party funding for assistive and augmentative communications technology. One of the most valuable features of this newsletter is the presentation of successful case histories where funding has been obtained via Medicare, Medicaid, vocational rehabilitation, insurance, or private sources.

Morris, M., & Golinker, L. (1991). *Assistive technology: A funding workbook*. Washington, DC: RESNA Press. Available from: RESNA, Suite 700, 1101 Connecticut Ave., NW, Washington, DC 20036, 202/857-1199.

The purpose of this book is to facilitate a better understanding of major funding streams and creative ways to eliminate current funding barriers. Part 1, A Road Map to Funding Sources, provides the reader with potential state and federal funding sources. Part 2, An Outline of Federal Laws and Rules, describes the three principal sources of support for assistive technology funding: Medicaid, programs under the Individuals With Disabilities Act, and the Rehabilitation Act and its amendments.

National Cristina Foundation, 42 Hillcrest Drive, Pelham Manor, New York 10803, 914/738-7494; FAX: 914/738-1571.

The National Cristina Foundation is a not-for-profit foundation directing commercially obsolete computers, computer equipment, audio and video equipment to organizations training people with disabilities, the disadvantaged, and students at risk. All equipment and technology are distributed to these training organizations or agencies at no cost. The Foundation works within national and state frameworks that include departments of education and rehabilitation. In addition, organizations that provide education, rehabilitation, or job training to persons with special needs may be recipients of donated technology.

National School Boards Association & Jostens Learning Corp. (1989). *On line, financing strategies for educational technology*. Alexandria, VA: NSBA.

This volume discusses innovative and creative financing alternatives to accomplish the goal of providing technology for all students. Funding sources at state and federal government levels, long-term and special financing procedures, and partnerships that can empower a district for technology acquisitions are examined. Also included are reviews of ongoing maintenance costs for technology implementation and creative ways to meet those costs.

November, A. (1990, Feb.). Big dreams, no money. *Classroom Computer Learning, 10*(5), 14, 18-19.

Two programs that used innovative ideas to raise funds for implementing new instructional technology are described. Setting up a nonprofit, school-based foundation is suggested as a method that can help provide relief for funding problems.

Sloane, E. (1991). *The Sloane Report.* Miami, FL: Author. Available from: Dr. Eydie Sloane, 8306 Mills Drive, Suite 518, Miami, FL 33183, 305/251-2199.

The Sloane Report is a monthly newsletter reporting and analyzing events in the personal computer industry. Periodic supplements cover the following topics: resources for computer access for the disabled; software and hardware evaluations, reviews and recommendations; and funding issues and not-so-common funding sources for public and private non-profit organizations. Copies of the October, 1990 "Funding Supplement" are available in limited quantities.

Splittgerber, F., & Stirzaker, N. (1984). Guidelines for financing school district computer services. *School Business Affairs, 50*(5), 30, 32, 80-81.

School districts can obtain computer services with purchase, lease, or network options. The advantages and disadvantages of each are explained. Guidelines are offered for assessing needs and determining costs of computer services.

Hardware Resources

ABLEDATA, Adaptive Equipment Center, Newington Children's Hospital, 181 East Cedar Street, Newington, CT 06111, 203/667- 5405, 800/344-5405.

ABLEDATA is a disability-related product database with more than 15,000 commercially available products from over 1,900 manufacturers. Detailed information is included on products for independent living, personal care, transportation, communication, and recreation.

Apple Computer, Inc., 20525 Mariana Avenue, Cupertino, CA 95014, 408/996-1010.

Apple's Office of Special Education focuses on three broad goals: increasing awareness of available technology for persons with disabilities, providing information, and developing accessible products. Services include operation of Apple Solutions, Apple Bulletin Board, and the establishment of Apple's Alliance for Technology Access community-based resource centers. Apple- related special education resources are available in both print and on-line formats.

Center for Special Education Technology. (1989). *Directory of assistive technology data sources*. Reston, VA: The Council for Exceptional Children.

This annotated directory of assistive technology data sources will help administrators locate current product information. The directory includes entries of both on-line and print databases. In analyzing each database, the Center provides information concerning (a) disability areas served, (b) number and type of products, (c) information provided, (d) cost to access the database, and (e) access.

Center for Special Education Technology. (1989). *Tech Use Guide: Computer Access*. Reston, VA: The Council for Exceptional Children.

This Tech Use Guide lists resources for high technology adaptive input devices, output devices, computer interfaces, and videos.

IBM Technical Support Center for Persons with Disabilities, P.O. Box 2150, Atlanta, GA 30055, 800/426-2133.

The Center was created to help health care leaders, agency directors, policy makers, employers, educators, public officials, and individuals learn how technology can improve the quality of life for the disabled person in the school, home, and workplace. The Center's toll-free 800 number is maintained 24 hours a day to provide general information on assistive devices, software, and services for disabled persons; and to accept requests for specific materials.

Sources and Evaluation

Center for Special Education Technology. (1990). *Directory of software data sources.* Reston, VA: The Council For Exceptional Children.

The Center has compiled this annotated directory of software databases to assist special educators in their search for high quality instructional software. The directory includes both on- line and print databases. The directory is organized into the following four sections:

- commercial software/special education focus
- commercial software/regular education focus
- public domain software/special education focus
- resources for software reviews

The final section lists newsletters, bulletins, and journals which review software in terms of special education applications.

Hancock, E. (1991). *The 1990-91 educational software preview guide.* Eugene, OR: ISTE.

Designed to assist people in locating software for preview, the guide lists more than 500 titles of favorably reviewed software for K- 12 classroom use. It was developed by the Educational Software Evaluation Consortium, which represents 30 computer education organizations in North America.

Heck, W. P., & Johnson, J. (1984). *Guidelines for evaluating computerized instructional materials.* Reston, VA: National Council of Teachers of Mathematics.

This document provides administrators with guidelines for choosing educational software. Its usefulness is not confined to mathematics; it is valuable for evaluating software in any discipline. Reproducible evaluation instruments are included.

MicroSIFT. (1986). *Evaluator's guide for microcomputer-based instructional packages.* Eugene, OR: ISTE.

This resource describes step-by-step procedures for software evaluation. Included in the guide are sample reviews, evaluation forms, and a glossary.

Copyright Policy

Gamble, L., & Anderson, L. (1989). Nine easy steps to avoiding software copyright infringement. *NASSP Bulletin, 73*(518), 90-93.

To avoid microcomputer software copyright infringement, administrators must be aware of the law, read the software agreements, maintain good records, submit all software registration cards, provide secure storage, post warnings, be consistent when establishing and enforcing policies, consider a site license, and ensure the legality of currently owned software.

Gemignani, M. (1989). Copyright law as it applies to computer software. *College Mathematics Journal, 20*(4), 332-338.

This paper discusses copyright laws applied to students and educators. Concepts including infringement, contributory infringement, first sale doctrine, and licenses are considered. A sample university policy statement to avoid liability is presented.

Goldsmith, K. (1989). Copyright for public schools. *School Law Bulletin, 20*(3), 10-17.

This article provides guidelines intended to help teachers, librarians, and administrators recognize when they must obtain permission to copy, perform, or display a work. It reviews the exceptions to the copyright law and its application to photocopying, reproduction by libraries and archives, videotaping, live and transmitted performances, and computer programs.

MacEoin, D. A. (1981). *Finding answers to copyright questions: Guide to publications on copyrights*. Fairfax, VA: NAVA, International Communications Industries Association.

A comprehensive annotated bibliography of publications focused on copyrights. Included are entries on educational media, off-air taping for educational use, and microcomputers.

Software Resources

Apple Access Curriculum Software Guides and Education Solution Guides. Available through local Apple Dealers.

Closing the Gap 1991 Resource Guide. Available from: Closing The Gap, P.O. Box 68, Henderson, MN 56044, 612/248-3294.

CUE SoftSwap, Computer Using Educators, Inc., P.O. Box 2087, Menlo Park, CA 94026.

Only the Best 1991: The Annual Guide to Highest-Rated Educational Software Preschool-Grade 12. Available from: R.R. Bowker, P.O. Box 762, New York, NY 10011, 800/521-8110.

Public Domain Software Sources

Big Red Apple Club, 1105 South 13th Street, Norfolk, NE 68701, 402/379-4608.

Center for Adapted Technology, 5755 West Alameda, Lakewood, CO 80226, 303/233-1666.

Facts on File, 460 Park Avenue South, New York, NY 10016, 800/322-8755.

International Apple Core Public Domain Library, 908 Georgia Street, Santa Anna, CA 95054, 408/262-9114.

Public Domain Exchange, 673 Hermitage Place, San Jose, CA 95134, 408/942-0309.

Public Domain Library of the Duncan Institute, Box 138CS, 18 Duncan Drive, New Port Richey, FL 33552, 813/848-0413.

SoftSwap, San Mateo County Office of Education, 333 Main Street, Redwood, CA 94063, 415/685-7265.

Software Publishers

Broderbund, P. O. Box 12947, San Rafael, CA 94913, 800/521-6263, 415/492-3200.

Davidson & Associates, 3135 Kashiwa Street, Torrance, CA 90505, 800/545-7677, 213/534-4070.

Don Johnston Developmental Equipment, Inc., P.O. Box 639, 1000 N. Rand Road, Building 115, Wauconda, IL 60084, 800/999-4660.

Hartley Courseware, Inc., 133 Bridge Street, Diamondale, MI 48821, 800/247-1380.

IBM Direct, PC Software Division, One Culver Road, Dayton, NJ 08810, 800/IBM-2468.

Jostens Learning Corp., 6170 Cornerstone Court East, San Diego, CA 92121, 619/587-0087.

Learning Company, 64 Kaiser Drive, Fremont, CA 94555, 800/852- 2255.

MECC, 3490 Lexington Avenue North, St. Paul, MN 55112, 800/228- 3504, 800/782-0032.

Scholastic Software, P.O. Box 7502, 2931 East McCarty Street, Jefferson City, MO 65102, 800/541-5513.

Sunburst, 101 Castleton Street, Pleasantville, NY 10570, 800/628- 8897.

Teacher Support Software, 1035 NW 57th Street, Gainesville, FL 32605, 800/228-2871.

Tom Snyder Productions, 90 Sherman Street, Cambridge, MA 02140, 800/342-0236.

Weekly Reader Software, Optimum Resource, 10 Station Place, Norfolk, CT 06058, 800/327-1473, 203/542-5553.

William K. Bradford Publishing Co., 594 Merrett Road, Lexington, MA 02173, 800/421-2009.

Wings for Learning, Inc., P.O. Box 660002, 1600 Green Hill Road, Scotts Valley, CA 95067, 800/321-7511.

Networks

Kaufman, D. (1985). Before you choose a network, consider... *Electronic Education, 4*(6), 25, 27-28.

This article discusses microcomputer network benefits; points out their current shortcomings in the areas of software availability and legal use, required equipment, and vendor responsibility; describes how to set up a worthwhile specialized network despite these shortcomings; and outlines reasons for expecting networks to play a larger future role in education.

Telecommunications

Center For Special Education Technology. (1991). *Tech Use Guide: Telecommunication Networks*. Reston, VA: The Council For Exceptional Children.

This guide provides an overview of telecommunications technology: how it works and how it can be applied in the special education classroom and in the home. Some of the telecommunication applications discussed are: joint learning experiences, development of joint newsletters or databases, and cross-age tutoring projects. One of the most valuable features of this guide is the annotated resource section. Included are listings of networks for both educators and students, and special projects in the schools.

Eiser, L. (1990, November). Keeping in touch: A guide to online telecommunication services. *Technology & Learning, 11*(3), 36-43.

This article provides a brief overview of the features and benefits of telecommunication for administrators, classroom teachers, and students. A summary of eight important online services and a detailed chart that compares features and costs is included.

Kurshan, B. (1990, April). Educational telecommunications connections for the classroom Part 2. *Computing Teacher, 17*(7), 51-52.

Some of the new areas being opened to education in the telecommunications field are examined in this article:

- videotex services
- statewide school district networks
- international networks and online services
- online services developed by Regional Bell Operating Companies

References include entries on videotex services and networks/online services.

Cable and Public Television

Corporation for Public Broadcasting (CPB). (1991). *National survey of school uses of television and video*. Available from: Andy Russell, Deputy Director, CPB Policy Development and Planning, 202/879-9671.

The Corporation for Public Broadcasting is currently conducting a national study on the availability, resources, support, and uses of instructional television. More than 700 superintendents, 2,000 principals, and 4,000 teachers will be surveyed, each selected on a random basis, to provide nationally representative results. The survey data collection will continue through Spring 1991. A full report will be available Fall 1991.

Koepke, M. (1991, March). Partners in science. *Teacher Magazine*, pp. 50-54.

The article describes the collaborative efforts of public television producers and Chicago-area teachers that have resulted in a 13-part TV series"The New Explorers," 1,000 pages of innovative teaching ideas, and a new science-resource network for Chicago area schools. The network is designed to expose students to science and scientists and to serve as a model for partnerships between schools and scientific institutions nationwide.

Kurshan, B. (1990). Educational telecommunications connections for the classroom Part 1. *The Computing Teacher, 17*(6), 30-35.

This article discusses the growing use of telecommunications in the classroom and lists 30 projects and networks currently available to educators. Highlights include general online services; databases; news services; local area projects; worldwide projects; electronic mail projects, including AT&T's Long Distance Learning Network (LDLN); and networks for higher education.

South Carolina Educational Television Network Columbia. (1989). *1989-90 Instructional television building coordinator's guide*. Columbia, SC: South Carolina State Department of Education. (ERIC Document Reproduction Service No. ED 318 449)

This guide is designed to help instructional technology building coordinators with the integration of television, radio, and computer resources into their school's curricula. This guide can be used throughout the year as a scheduling aid and reference manual.

Distance Learning

Kitchen, K., & Kitchen, W. (1988). *Two-way interactive television for distance learning: A primer*. Alexandria, VA: NSBA.

This report describes how several school districts are using long-distance communication in a collaborative way to make their schools more productive. Detailed in this publication is a step- by-step process for districts interested in installing two-way interactive television to expand the educational horizons of their students.

Office of Technology Assessment (OTA). (1989). *Linking for learning: A new course for education*. Washington, DC: GPO.

OTA examined the use of technology for distance learning to improve the quality of education for students and training for teachers. Findings indicate that states, localities, the federal government, and the private sector all have roles to play in planning, funding, and implementing distance education. Future development will require involvement of these sectors in four major areas: telecommunications policy; research, evaluation, and dissemination; the teacher's role; and the infrastructure for distance learning.

Ongoing Monitoring

Gillman, T. V. (1989). Change in public education: A technological perspective. *Trends & Issues* (Series No. 1). Eugene, OR: ERIC Clearinghouse on Educational Management.

This paper is one in a series of studies which highlight and synthesize recent research and practice. It focuses on the adoption, implementation, and integration of microcomputers into the instructional program. Included is a case study of Sacramento City Unified School District's strategic plan. This strategy incorporates planning and feedback processes that are critical to the full integration of educational technology into the schools.

Lai, M. K. (1984). *Evaluating a computer education program qualitatively and quantitatively*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans, LA. (ERIC Document Reproduction Service No. ED 248 268)

This evaluation of a course integrating the SCOPE computer program in mathematics and science into the curriculum for students, grades 6-12, was conducted to: (1) provide feedback to facilitate improvement of the program; (2) determine course effects; and (3) provide practitioners with an effective method of evaluating microcomputer use in educational settings. Appendices include an evaluation instrument designed to obtain feedback.

Mowe, R. (1990). *Evaluating computer integration in the elementary school: A step by step guide*. Eugene, OR: ISTE.

This guidebook is designed to assist principals in the task of evaluating the effectiveness of computer integration into the curriculum. Chapters on planning, information gathering, interpretation, and reporting are followed by questionnaires and other materials to use in actual evaluations. Principals can customize the questionnaires to studies of their own design.

Roblyer, M. D. (1988). The effectiveness of microcomputers in education: A review of the research from 1980-1987. *Technological Horizons in Education, 16*(2), 85-89.

This article reviews and summarizes the research from 1980-1987 that has focused on the impact of microcomputer applications on instruction. Results indicate that use of science simulations, word processing in writing instruction, and LOGO applications to teach problem solving and increase creativity may be especially good areas to direct microcomputer resources in the future.

Wepner, S., & Kramer, S. (1984). *Designing your computer curriculum: A process approach*. (ERIC Document Reproduction Service No. ED 247 900)

Four essential steps for integrating computer technology into a school district's curriculum needs assessment, planning, implementation, and evaluation are described. The discussion of evaluation delineates how to solicit the most appropriate feedback regarding the district's computer curriculum. In addition, Wepner notes that evaluation should be keyed to goals and include evaluation of the personnel directing and implementing the program.

Associations

Association for Educational Communications and Technology (AECT), 1126 16th Street, NW, Washington, DC 20036.

Association for Supervision and Curriculum Development (ASCD), Curriculum/Technology Resource Center, 1250 N. Pitt Street, Alexandria, VA 22314.

Cable in the Classroom, 1900 N. Beauregard Street, Suite 108, Alexandria, VA 22311.

International Association for Computing in Education (IACE), 1230 17th Street, NW, Washington, DC 20036.

International Society for Technology in Education (ISTE), University of Oregon, 1787 Agate Street, Eugene, OR 97403.

Public Broadcasting Service, 1320 Braddock Place, Alexandria, VA 22314.

Technology and Media (TAM) Division of The Council for Exceptional Children, 1920 Association Drive, Reston, VA 22091.

Periodicals

Cable in the Classroom, 141 Portland Street, Suite 8100, Cambridge, MA 02139.

The Catalyst, Western Center for Microcomputers in Special Education, 1259 El Camino Real, Suite 275, Menlo Park, CA 94025.

Classroom Computer Learning, 2451 East River Road, Dayton, OH 45439.

Closing The Gap, P.O. Box 68, Henderson, MN 56044.

Computer Curriculum Resources, Learning Publications, Inc., P. O. Box 1326, Holmes Beach, FL 34218.

The Computing Teacher, Department of Computer & Information Science, University of Oregon, 1787 Agate Street, Eugene, OR 97403.

Educational Leadership, Journal of the Association for Supervision and Curriculum Development, 1250 N. Pitt Street, Alexandria, VA 22314.

Electronic Learning, Scholastic, Inc., P.O. Box 2041, Mahopac, NY 10541.

Insider's Letter, National School Boards Association, Institute for the Transfer of Technology to Education, 1680 Duke Street, Alexandria, VA 22314.

Journal of Special Education Technology, Peabody College at Vanderbilt, Box 328, Nashville, TN 37203.

NASSP Bulletin, National Association of Secondary School Principals, 1904 Association Drive, Reston, VA 22091.

School Business Affairs, Association of School Business Officials International, 11401 N. Shore Drive, Reston, VA 22090.

Teaching and Computers, Scholastic, Inc., P.O. Box 2040, Mahopac, NY 10541.

Technology & Learning, Peter Li, Inc., 2451 E. River Road, Dayton, OH 45439.

TechTrends, Association for Educational Communications and Technology, 1025 Vermont Avenue, NW, Suite 820, Washington, DC 20005.